

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

1. (Currently Amended) A multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient wavelet filter bank, said multicarrier transmitter comprises:

a signal point mapping unit for performing symbol mapping of a series of information;

a serial-to-parallel converter for converting serial data as said symbol mapped series of information to parallel data;

a first inverse wavelet transformer including a plurality of real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer performing a first inverse wavelet transform on said parallel data;

a second inverse wavelet transformer including: real coefficient wavelet filters of said first inverse wavelet transformer where Hilbert transform has been made, said second inverse wavelet transformer performing a second inverse wavelet transform on said parallel data; and

a modulator for performing single-sideband (SSB) modulation by using the output an in-phase signal of complex information from said first inverse wavelet transformer ~~as an in-phase signal of complex information~~ and the output an orthogonal signal of complex information from the second inverse wavelet transformer ~~as an orthogonal signal of complex information~~,

wherein said first inverse wavelet transformer includes a discrete cosine transformer for inputting the parallel data from said serial-to-parallel converter and for outputting the in-phase signal of complex information, and

wherein said second inverse wavelet transformer includes a discrete sine transformer for inputting the parallel data from said serial-to-parallel converter and for outputting the orthogonal signal of complex information.

2. (Currently Amended) The multicarrier transmitter according to claim 1, wherein said first inverse wavelet transformer comprises:

~~a discrete cosine transformer for inputting parallel data from the serial-to-parallel converter;~~

a first prototype filter including a polyphase filter having a real coefficient, said first prototype filter inputting output data of said discrete cosine transformer;

M upsamplers for inputting output data of said first prototype filter; and

M-1 single sample delay elements for inputting output data of said upsamplers.

3. (Currently Amended) The multicarrier transmitter according to claim 1, wherein said second inverse wavelet transformer comprises:

~~a discrete sine transformer for inputting parallel data from said serial-to-parallel converter;~~

a second prototype filter including a polyphase filter having a real coefficient, said second prototype filter inputting output data of said discrete sine transformer;

M upsamplers for inputting output data of said second prototype filter; and

M-1 single sample delay elements for inputting output data of said upsamplers.

4. (Currently Amended) The multicarrier transmitter according to claim 1, wherein said first inverse wavelet transformer comprises:

~~a discrete cosine transformer for inputting parallel data from the serial-to-parallel converter;~~

a first prototype filter including a polyphase filter having a real coefficient, said first prototype filter inputting output data of said discrete cosine transformer;

M upsamplers for inputting output data of said first prototype filter; and

M-1 single sample delay elements for inputting output data of said upsamplers; and

said second inverse wavelet transformer comprises:

~~a discrete sine transformer for inputting parallel data from said serial-to-parallel converter;~~

a second prototype filter including a polyphase filter having a real coefficient, said second prototype filter inputting output data of said discrete sine transformer;

M upsamplers for inputting output data of said second prototype filter; and

M-1 single sample delay elements for inputting output data of said upsamplers.

5-10. (Canceled)

11. (Currently Amended) Multicarrier communications apparatus comprising a multicarrier transmitter and a multicarrier receiver, said multicarrier communications apparatus performing data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank including M real coefficient wavelet filters (M being a positive integer),

said multicarrier ~~communications~~ transmitter comprising:

a signal point mapping unit for converting bit data to symbol data to map said symbol data on $M/2$ complex coordinate planes;

a serial-to-parallel converter for converting serial data as said mapped symbol data to parallel data;

a complex data decomposer for inputting said parallel data as well as decomposing complex data into a real part and an imaginary part so as to supply an in-phase component of complex information to the $(2n-1)$ th input to said first and said second inverse wavelet transformers and supply an orthogonal component to the $2n$ th input (where $1 \leq n \leq (M/2-1)$, a subcarrier number is 0 to $M-1$);

a first inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer outputting an in-phase signal of said complex data;

a second inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said second inverse wavelet transformer outputting an orthogonal signal of said complex data; and

a single-sideband (SSB) modulator for performing SSB modulation by using ~~the output~~
an in-phase signal of complex information from said first inverse wavelet transformer as an
~~in-phase signal of complex information~~ and ~~the output~~ an orthogonal signal of complex
information from said second inverse wavelet transformer as an ~~orthogonal signal of complex~~
~~information~~;

wherein said first inverse wavelet transformer includes a discrete cosine transformer for
inputting the parallel data from said complex data generator and for outputting the in-phase
signal of complex information, and

wherein said second inverse wavelet transformer includes a discrete sine transformer for
inputting the parallel data from said complex data generator and for outputting the orthogonal
signal of complex information, and

wherein ~~a detector~~ of said multicarrier receiver comprises:

a multiplier for downconverting a received bandpass signal as a receive signal of a
received bandpass signal to a baseband signal;

a local oscillator for providing said multiplier with a signal of a predetermined frequency;

an LPF for removing an unwanted signal outside the band of a baseband signal output
from said multiplier;

a first wavelet transformer comprising M real coefficient wavelet filters orthogonal to
each other, said first wavelet transformer inputting the output data from said LPF; and

a complex data generator for generating complex data by using the $(2n-1)$ th output from
said first wavelet transformer as an in-phase component of complex information and $2n$ th output
as an orthogonal component (where $1 \leq n \leq (M/2-1)$, a subcarrier number is 0 to M-1);

~~wherein said first inverse wavelet transformer includes a discrete cosine transformer for inputting the parallel data from said complex data generator, and~~

~~wherein said second inverse wavelet transformer includes a discrete sine transformer for inputting the parallel data from said complex data generator.~~

12. (Previously Amended) Multicarrier communications apparatus comprising a multicarrier transmitter and a multicarrier receiver, said multicarrier communications apparatus performing data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank including M real coefficient wavelet filters (M being a positive integer),

said multicarrier communications transmitter comprising:

a synchronization data generator for generating a signal as data known to said multicarrier receiver and the multicarrier transmitter according to claim 11 as a modulator for inputting said signal as known data from said synchronization data generator; and

said multicarrier receiver comprising:

the detector according to claim 11 for outputting adjacent complex subcarrier data including a subcarrier pair and a synchronization estimation circuit for estimating a symbol synchronization timing from the difference between said adjacent complex subcarrier data items.

13. (Canceled)

14. (Currently Amended) A multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient wavelet filter bank, said

multicarrier transmitter comprising:

a signal point mapping unit for performing symbol mapping of a series of information;

a serial-to-parallel converter for converting serial data as said symbol mapped series of information to parallel data;

a first inverse wavelet transformer for performing a first inverse wavelet transform on said parallel data, said first inverse wavelet transformer including a plurality of real coefficient wavelet filters;

a second inverse wavelet transformer for performing a second inverse wavelet transform on said parallel data, said second inverse wavelet transformer including a plurality of real coefficient wavelet filters; and

a modulator for performing modulation by using ~~the output~~ an in-phase signal of complex information from said first inverse wavelet transformer ~~as an in-phase signal of complex information~~ and ~~the output~~ an orthogonal signal of complex information from said second inverse transformer ~~as an orthogonal signal of complex information~~,

wherein said first inverse wavelet transformer includes a discrete cosine transformer for inputting the parallel data from said serial-to-parallel converter and for outputting the in-phase signal of complex information, and

wherein said second inverse wavelet transformer includes a discrete sine transformer for inputting the parallel data from said serial-to-parallel converter and for outputting the orthogonal signal of complex information.

15. (Canceled)

16. (Previously Presented) A multicarrier communications apparatus comprising the multicarrier transmitter according to claim 14 and a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver comprising:

- a multiplier for downconverting a received bandpass signal to a baseband signal;

- a local oscillator for providing said multiplier with a signal of a predetermined frequency;

- an LPF for removing an unwanted signal outside the band of baseband signal output from said multiplier;

- a first wavelet transformer for performing a first wavelet transform on an output signal from said LPF, said first wavelet transformer including a plurality of real coefficient wavelet filters;

- a second wavelet transformer for performing a second wavelet transform on the output signal from said LPF, said second wavelet transformer including a plurality of real coefficient wavelet filters;

- an equalizer for equalizing each parallel signal of an in-phase signal output from said first wavelet transformer and an orthogonal signal output from said second wavelet transformer as a complex signal of each subcarrier;

- a parallel-to-serial converter for converting an equalized parallel signal output from said equalizer to serial data; and

a determination unit for determining serial data output from said parallel-to-serial converter, wherein:

said multicarrier communications apparatus performs data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank.